Dual-Axis Solar Tracking System With Weather Updates

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Abstract- *This research presents an analysis of a dual-axis solar tracking system with weather updates using Arduino.By 2035 the solar energy will become the most used source of energy for the generation of electricity or we can say the production of electricity in the world. This will also lead to greater use of low-cost digital technology. Most of the solar panels are fixed type, so in order to maximize the power generation, we are using the solar tracker which will follow the rotation of the sun throughout the day. If we compare the total output of dual as well as single-axis solar tracker system, we found that it has better performance in terms of current, voltage, and power output. There is an increase in performance of around 25% of the power. We are using the light-dependent resistors (LDRs) as a sensor as a tracking mechanism for the sun radiations and two servomotors connected vertically and horizontally to direct the position of the panel. The proposed automatic tracker is that it controls the elevation and orientation angles of solar panel such that the panel will maintain perpendicular to the sunlight for the maximum absorption of light rays. And software part is done with the help of code written in Arduino Uno controller.*

Keywords- Introduction, related work, advantages, disadvantages, conclusion, future scope, references.

I. INTRODUCTION

In the present scenario, all are using a solar panel for getting the power as an output from sunlight.

So, we have come up with a dual-axis solar tracking system that can rotate automatically based on the rotation of the Sun. This dual-axis solar tracking system is even more efficient than the single-axis tracker which will also give them more flexibility in the rotation of solar panels and maximize the power generation output. This dual-axis solar tracker takes the sun rays an input and converts it into electrical energy, this electrical energy which is obtained, will fulfil the majority of the country needs.

It consists of two motors for perpendicular as well as for horizontal axis rotation. We are using Arduino (ATmega 328P) to control both the motors for the vertical and horizontal axis in such a way that the maximum amount of light which ensures that the solar panel is also receiving the maximum sunlight for maximum power generation. Solar panel are exposed to sunlight, the angle at which the rays will meet at the surface of the solar panel. So, we are using this solar tracker, which will help us to minimize the angle to the panel in such a way that light strikes them perpendicular to the surface.

II. RELATED WORK

The components required as follows: -

1. **Arduino Uno:** It is a micro-controller (ATmesga328P) .It carries with 14 input/output pins,16Mhz crystal,power jack,reset button a USB connector and a ICSP header.

2. **Raindrop sensor:** It is essentially a module which is employed for the detection of the rain.this board is formed from copper to which when the rain drops will fall on the surface of the board, the overall resistance of the copper board are get reflected(reduced).

3. **Temperature and Humidity sensor :**DHT11 may be a low cost sensor which can provide us the reliability and stability of the panel.It has only three pins -Vcc,Gnd and output pins.This will measure the moisture and temperature of the encircling environment of the solar array and provides it to the Arduino.

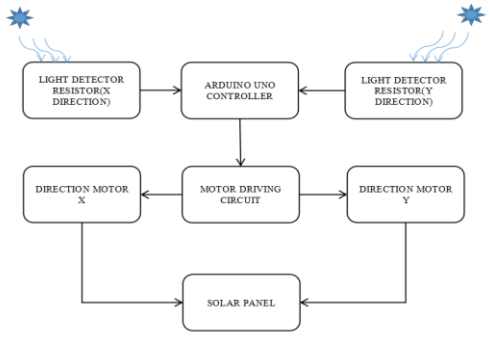
4. **Stepper motor:** It is an mechanical device which converts power to mechanical power.It will help to rotate the panel according the movement of the sun.

5. **Motor driver module(L293D):** It could be a module used for motors to regulate the speed of the 2 motors connected horizontally and vertically.It is 16 pin IC.It also provides the bidirectional currents at voltages from 5V to 25V.

6. **Light dependent resistors:** It is employed to detect the sunshine bopping up from the sun.As the sun rays will fall

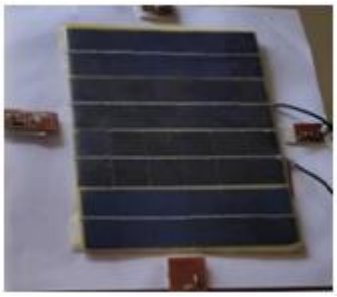
thereon ,the conductivity of the material will increase and therefore the photons are absorbed by the semiconductor.

BLOCK DIAGRAM

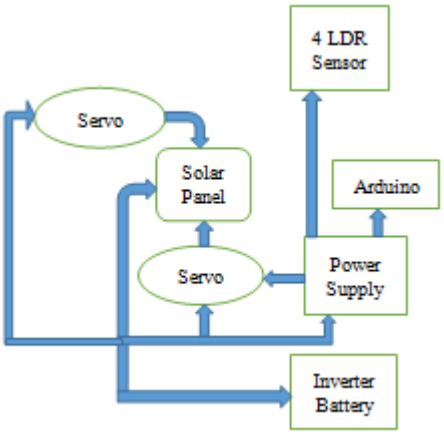


III. EXPERIMENTAL SETUP

- The tracking system can track loads of daylight in actual reality by PV panel rotation on several axis. In a dual-axis system we can track the sun in four directions as a result we will succeed with a lot of energy from the solar panel. throughout this emerge.
- Four LDR sensors, two servo motor and an Arduino micro-controller consist of our tracking system. One rest of the sensors and one motor is employed to incline the tracker in the sun's east-west route and the alternative rest of the sensors and also the opposite motor which is mounted at the bottom of the solar panel is employed to tilt the panel at intervals the sun's north-south route.
- The servo motor is performing operate to the following path of the sun. The two-servo motor and four LDR sensors are interfaced with a micro-controller that's scheming servo motor on the bottom of the sensor's input. Sunlight sense by LDR sensors and give the signal to the Arduino micro-controller. It receives signals from LDR sensors and its deciding rotation direction of servo motors.



Solar panel with 4 LDR sensors



- The diagram is showing that LDR sensors once sensing the sunshine forward the signal to Micro-controller. The micro-controller is a logical device that's attractive dealings on sensor place in and beginning the motor driver's track consequently. Assume if the sun changes its locality and go from east to west, it'll cause light absorption to vary on one device as associated with a totally different one. On the bottom of the sunlight intensity feature on sensors, the controller starts driver circuits and moves the servo motor to new positions where light falling on device pairs is the same. The constant method will maintain it up with a modification in the sun's locality enclosed by the sky. As a result, this planned model is in a position to capture supplementary sun rays and the system's solar energy conversion capability is greatly superior.

IV. ADVANTAGES

- High degree of flexibility, efficient.
- High energy output on good weather.
- Energy cost reduction.
- Low maintenance cost.
- It will reduce the electricity bill.
- High degree of accuracy.

V. DISADVANTAGES

- Lower lifespan.
- Low reliable.
- More complex design and control mechanism than single-axis tracker.
- Not more efficient in cloudy and overcast weather conditions like wind, dust etc.
- More maintenance is required due to the presence of rotating components.

VI. CONCLUSION

In this project, we have developed a demo model of a solar tracker to track the maximum intensity point of the light source so that the voltage gain at that point by the solar panel is maximum. The project is intended to be implemented with minimal resources. The circuitry is kept simple, understandable and user friendly.

VII. FUTURE SCOPE

The generation of energy from sunlight to electricity has tremendous scope in India. Also because of the geographical conditions of the country stands to its benefits. As in India, it receives solar radiations almost throughout the year. Solar plants do not produce any kind of pollution or greenhouse gases. Hence, it will have an indirect effect on the environment, if we use other energy resources which causes pollution to the environment. So, it is also called a pollution free source of energy. If we reduce the cost of the number of materials used in solar panel i.e., silver, silicone etc of the manufacture of the solar panel it will reduce the cost of the product. Despite many developments are being done and still, it faces some issues regarding cost factor, operational efficiency, feasibility demands etc.

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